WIDE V_{IN} DC/DC Power Solutions
Reliable Power for Demanding Systems

LM(2)5143/-Q1 Synchronous Buck Controller Design Tool

About | = Input Box | TERMS OF USE

Step 1: Operating Specifications

LM5143A-Q1

Single Output – 4 Phases

Input Voltage – Min, $V_{IN(min)}$	**30**	V
Input Voltage – Nom, $V_{IN(nom)}$	**49**	V
Input Voltage – Max, $V_{IN(max)}$	**50**	V
Output Voltage, V_{OUT}	**15**	V
Full Load Output Current, I_{OUT}	**70**	A
Switching Frequency, F_{SW}	**2200**	kHz
Frequency Set Resistor, R_T	10	kΩ
Ambient Temperature, T_A	**25**	°C

Step 2: Current Sense Resistors

Shunt current sensing

Required I_{OCP} Setpoint at $V_{IN(nom)}$	**30**	A
Recommended Sense Resistance	7.4	mΩ
Sense Resistance, R_S	**2**	mΩ
Min Inductor Sat Current, $I_{LO(SAT)}$	36.5	A
Max power loss in shunt	2.42	W
$I_{OUT(typ)}$ at OCP Inception: $V_{IN(min)}$	139.2	A
$V_{IN(nom)}$	136.5	A
$V_{IN(max)}$	136.4	A

Step 3: Buck Inductances

Ch1 Recommended Inductance	0.57	µH
Ch1 Inductance, L_{O1}	**1**	**µH**
Ch1 Inductor DCR	**2**	**mΩ**
ΔI_L as a % at $V_{IN(nom)}$	27	%

Step 4: Output Capacitors

Output Voltage Ripple Spec	**400**	**mV_{pk-pk}**
Minimum Output Capacitance	2.2	µF
Output Capacitance (derated), C_{OUT}	**580**	**µF**
Maximum Permitted ESR	84	mΩ
Output Capacitor ESR	**3**	**mΩ**
Resulting Output Voltage Ripple (max)	14	mV_{pk-pk}
Output Capacitor RMS Current (max)	1.38	A (rms)

Step 5: Input Capacitors

Input Voltage Ripple Spec	**2500**	**mV_{pk-pk}**
Minimum Input Capacitance	10	µF
Input Capacitance, C_{IN}	**20.047**	**µF**
Maximum Permitted ESR	120.7	mΩ
Input Capacitor ESR	**1**	**mΩ**
Resulting Input Voltage Ripple (max)	119	mV_{pk-pk}
Input Capacitor RMS Current (max)	8.75	A (rms)

Step 6: Soft-start, Hiccup, Dither, DEMB, MODE

Soft-Start Time, t_{SS}	**3**	**ms**
Soft-Start Capacitance, C_{SS}	100	nF
Hiccup Fault Time, t_{RES}	**12**	**ms**
RES Capacitance, C_{RES}	220	nF

DITHER Disabled

FPWM

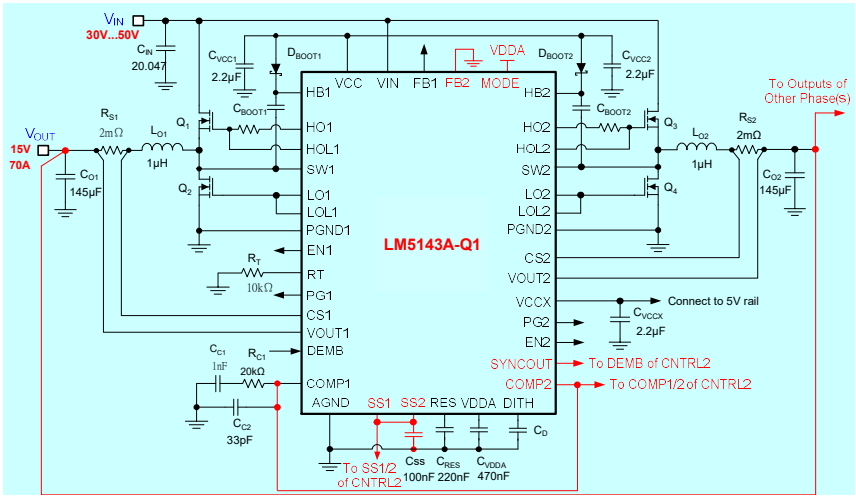
*Tie DITH to VDDA
* Tie DEMB to VDDA
* Tie MODE to VDDA

Step 7: Compensation Design

Load Pole Frequency	1648	Hz
ESR Zero Frequency	91	kHz
Desired Crossover Frequency	**60**	**kHz**
Error Amp Pole Frequency	2.5	Hz
Upper Feedback Resistor	**240**	**kΩ**
Lower Feedback Resistor	10	kΩ

Compensation Components

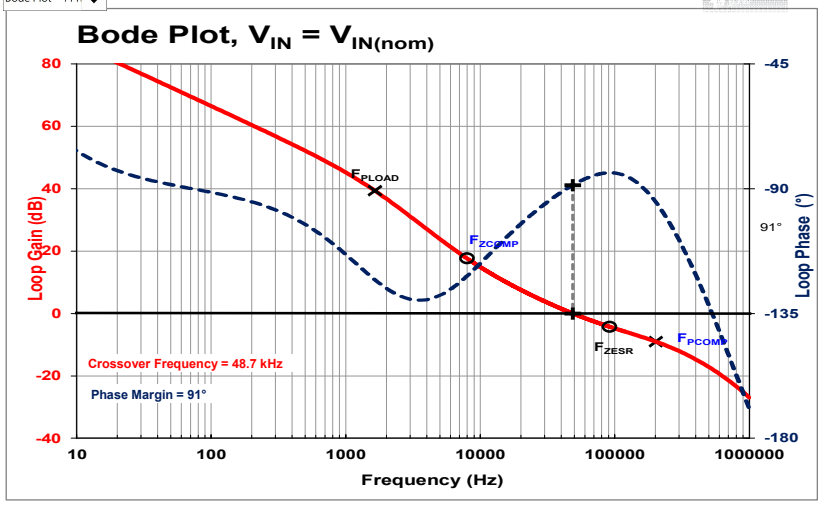
	Calculated /	Std Values	Std Values		Actual P/Z Frequencies
R_{C1}	27.3	27.4	**20**	**kΩ**	2 Hz (F_{PEA})
C_{C1}	1.0	1	**1**	**nF**	8.0 kHz (F_{ZCOMP})
C_{CZ}	57	56	**33**	**pF**	202 kHz (F_{PCOMP})



** For Single-Output Operation in 4-Phase Mode, tie both MODE pins to VDDA. Use FB1 of master IC to set VOUT. Connect FB2 of master IC to AGND. Connect FB2 of slave IC to VDDA to configure it as a slave **
** Slave controller (CNTRL2) not shown **
** Tie VCCX to GND if not used **

Wide Input Voltage

Bode Plot - 4 Ph



** Specify Inductor Core Loss ** 0.3 W

Efficiency / Power Loss Analyzer

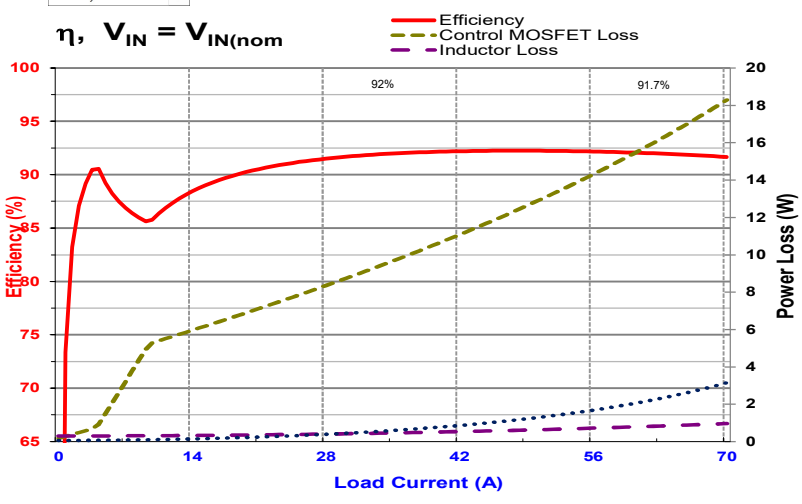
Step 8: Efficiency

	Power MOSFETs ISC0805NLS, ISC0805NLS High-side	Low-side	
On-State Resistance, $R_{DS(on)}$	**9.0**	**9.0**	mΩ
Total Gate Charge, Q_G	**13**	**13**	nC
Gate-Drain Charge, Q_{GD}	**4.7**	**4.7**	nC
Gate-Source Charge, Q_{GS}	**6**	**6**	nC
Output Charge, Q_{OSS}		**34**	nC
Output Capacitance, C_{OSS}	**280**	**280**	pF
Gate Resistance, R_G	**1**	**1**	Ω
Transconductance, g_{FS}	**73**	**73**	S
Gate-Source Threshold Voltage, V_{TH}	**1.6**	**1.6**	V
Body Diode Forward Voltage, V_{BD}	**0.92**	**0.92**	V
Body Diode Rev Recovery Charge, Q_{RR}		**28**	nC
Thermal Resistance, θ_{JA}	**50**	**50**	°C/W

External Schottky Diode (if applicable)

Schottky Fwd Voltage, V_{FWDsch}	**0.46**	V
Schottky Rev Recovery Charge, Q_{RRsch}	**1.5**	nC

Efficiency vs. IOUT - 4 Ph



Step 9: IC Power Loss

VCCX Connected

IC Power Dissipation	0.57	W
IC Junction Temperature (estimate)	44.9	°C